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DIRECTORATE OF
INTELLIGENCE

Industrial Facilities
(Non-Military)

Basic Imagery Interpretation Report

Perm Petroleum Refinery

Perm, USSR

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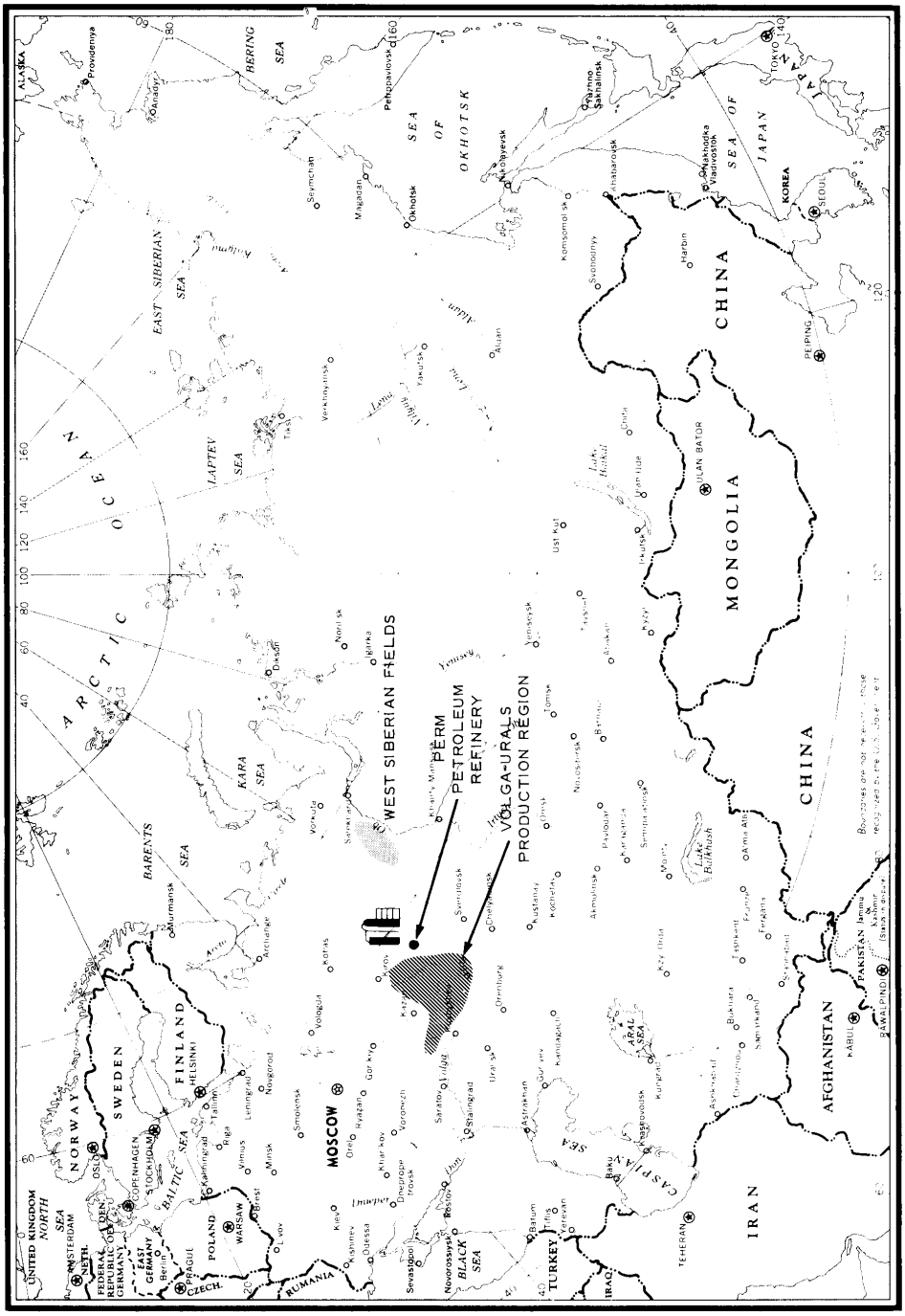

FIGURE 1. LOCATION MAP.

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INTRODUCTION

The Perm Petroleum Refinery is located on the northern edge of the Volga-Urals production region, approximately 6.5 nautical miles (nm) southwest of the center of Perm (see Figure 1). Crude oil is brought to the refinery via the Almetyevsk-Perm pipeline. Also, a pipeline brings gas from the West Siberian Fields into Perm. [1,2] Some of this gas is probably brought to the refinery for processing and in the future it will provide feedstock for the petrochemical plant being constructed a short distance southeast of the refinery. The petrochemical plant is connected to the refinery by a large pipe gallery.

The refinery is served by a spur from the Trans-Siberian railroad. Electric power is produced at the collocated Perm Heat and Thermal Power Plant TETS 9 Petroleum Refinery [redacted] and distributed to the various processing un25X1 through transformer substations located in the refinery.

The best coverage of the refinery, in August 1968, was the basis for most of the information in this report. Subsequent photography of the plant in January 1969 was of poor quality and showed only that the plant was operating and construction was continuing.

BASIC DESCRIPTION

Physical Features

The Perm refinery is one of the ten largest in the Soviet Union. It consists of three separate parts (see Figures 2 and 3). The refinery proper, which measures about 8,600 by 5,900 feet, contains all of the processing areas and part of the shipping and storage facilities. It is partially secured by wall and covers about 1,185 acres. The second part is a rail-served crude oil and products receiving, shipping and storage area which measures about 3,500 by 2,800 feet and covers about 225 acres. It is completely secured by wall and fence. The third part of the complex is a partially secured crude oil storage area of about 20 acres which measures approximately 850 by 800 feet. Ground scarring indicates that this storage area is being expanded by about 70 percent.

Operational Functions

The major refining equipment presently constructed and in operation at this refinery includes crude oil distillation units, catalytic and thermal cracking units, possible catalytic and thermal reforming units, and a possible polymerization unit. Also, there are several units for the processing, handling and storage of gaseous hydrocarbons, a lubricating oil plant, and several unidentified units which probably produce petrochemicals or their intermediates.

The simple fractionation of crude oil is accomplished by two multistage distillation units and by the atmospheric and vacuum fractionators in one and probably two combination units. These units produce the straight-run products such as gasoline, kerosene, diesel and fuel oils, as well as feedstocks for the various secondary processing units.

Secondary processing is accomplished by a wide range of facilities. The catalytic processing facilities include cracking units and possible reforming units. The two catalytic cracking units are of the moving-bed type and have been tentatively identified as Thermofor crackers. A possible catalytic reformer is believed to be either of the moving-bed or fluid-bed type, both of which use nonprecious-metal-oxide catalysts. A probable catalytic unit which in some ways resembles a reformer has also been observed. The secondary thermal processing facilities include one thermal cracker plus at least two probable additional thermal crackers. There are also five other thermal units, possibly used for reforming or cracking. Two of these units are in line with the fractionators in the combination units and the other three are in a separate area. Both of the catalytic cracking units and two of the probable thermal crackers have associated light-ends recovery units. An additional possible light-ends unit is located near one of the unidentified processing units.

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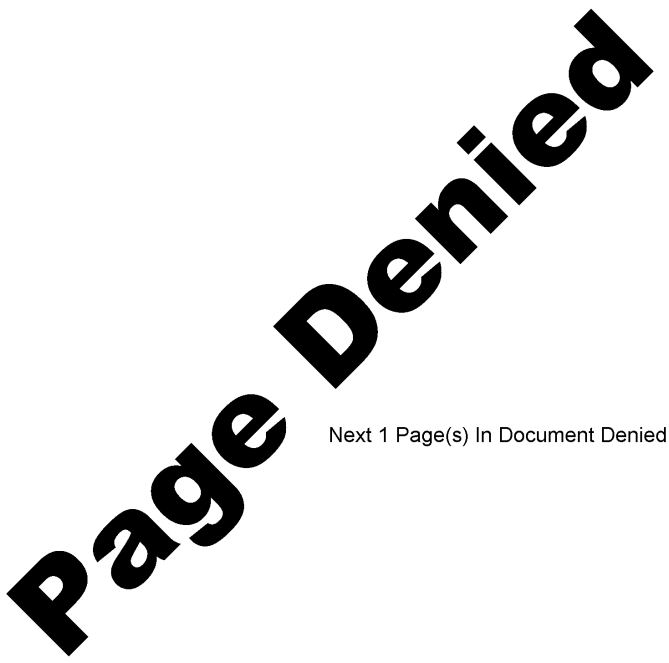

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Cracking increases the output of gasoline, and the associated light-ends recovery provides feedstock for various gas processing units. Polymerization produces blending stock to upgrade the octane rating of gasolines and petrochemical feedstocks. Reforming improves the quality of the straight-run gasoline and at the same time produces additional fuel oil and gases. A large percentage of the gaseous hydrocarbons that are processed and stored at this refinery are probably used as feedstock for petrochemicals and/or petrochemical intermediates. The use of gases will probably increase when the nearby petrochemical plant is in operation.

The products of the refinery include straight-run gasoline, cracked and blended gasolines in a fairly wide range of octane ratings, kerosene, diesel and fuel oils, gaseous hydrocarbons, lubricating oils, waxes, asphaltic materials, and possibly aromatics and petrochemicals or intermediates for petrochemical production.

Construction and Operational Status

Based on collateral information, construction probably began in 1956 and the first production was accomplished in late 1959. 3/ The earliest photography used in this study is from June 1963. At that time the following facilities were complete and in operation:

1. At least 75 percent of the primary distillation facilities.
2. Two catalytic cracking units.
3. One and probably three thermal cracking units.
4. Two small thermal processing (possibly reforming or cracking) units.
5. Lubricating oil processing equipment and storage tanks.
6. At least 90 percent of the products storage facilities.
7. Approximately 40 percent of the crude oil storage facilities.
8. Approximately 80 percent of the gaseous hydrocarbons processing and storage facilities.
9. All of the administration, support, and shipping facilities, and most of the water treatment and storage facilities.

By early 1964, a third possible thermal reforming or cracking unit, a possible catalytic conversion/treating unit and several unidentified processing units had been added. Work on a second combination unit and on a possible catalytic reforming unit was in the very early stages in 1964, and by June 1967 they appeared to be complete and in operation. The crude oil storage areas and the support facilities were steadily expanded through mid-1967. Only one major new unit, an unidentified secondary processing facility, was completed after June 1967. By August 1968, the facilities in the refinery complex were as shown in Figure 3. There were six areas of major construction in the refinery proper, and the storage areas for crude oil were being expanded. Poor-quality coverage of January 1969 showed that construction was continuing.

On all missions studied the refinery appeared to be in operation.

Facilities and Equipment

The Perm refinery contains a wide range of equipment, from old, small-capacity units to units of the latest design found in the Soviet Union. Identification of some units and items of equipment is tentative because of the lack of good-quality large-scale stereoscopic coverage of the refinery. Table I lists the facilities and equipment within the refinery complex according to functional areas, but it does not include the buildings or processing equipment which are a part of the units under construction. In the table, measurements are rounded to the nearest half-meter.

Table 1. Equipment and Facilities at the Perm Petroleum Refinery (keyed to Figure 3).

Area	Functional Description	Equipment and Facilities
A	Water Treatment and Storage	6 Miscellaneous buildings 8 Cylindrical storage tanks 2 [redacted] 4 12-meter-diameter 1 [redacted] 1 6-meter-diameter 7 Treatment, settling, and storage basins 3 Water storage reservoirs
B	Waste Gas Disposal	7 Miscellaneous buildings 1 Flare tower 2 Semiburied storage tanks (not measured) 10 Horizontal storage tanks each 27 meters long 5 Horizontal drums, probable condensate accumulators each [redacted] 1 Gasholder 27 meters in diameter 1 Waste basin
C	Storage	7 Miscellaneous buildings 1 Garage 3 Semiburied tanks (not measured) 1 Buried reservoir or group of horizontal tanks (not measured)
D	Thermal Cracking	1 Cracking unit with 3 columns (reactor, flash chamber, fractionator), 2 pipe furnaces, and 1 compressor building 4 Cooling towers, each with 3 cells 3 Support buildings 1 Flare tower 5 Cylindrical storage tanks 3 [redacted] 2
E	U/I Processing (1) Processing	1 Large-diameter column, possible absorber 1 Processing building with at least 4 thin columns or pieces of equipment protruding through roof 1 Possible compressor/control building 1 Possible building u/c 2 Cylindrical storage tanks each [redacted]
	(2) U/I Processing (Possible Petrochemical Production)	2 Units, each with 1 large processing building with attached covered processing unit and 2 tall columns, 1 L-shaped compressor/control building, 1 bank of heat exchangers/cooling coils, 2 support buildings, 5 cylindrical processing or storage tanks, 1 cylindrical tank [redacted] and 5 horizontal tanks each 6 meters long 7 Miscellaneous buildings 1 Building with 2 horizontal settling tanks each 6 meters long 6 Cooling towers 3 with 10 cells each 1 with 5 cells 2 with 3 cells each 12 Cylindrical storage tanks 3 12-meter-diameter 8 9-meter-diameter 1 [redacted] 4 Water storage reservoirs

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Area	Functional Description	Equipment and Facilities
	(3) Construction Activity	Very early stage
	(4) Construction Activity	U/I Unit -- midstage of construction
F	Possible Reforming and Fractionating	
	(1) Possible Catalytic Reforming	2 Possible reforming units (fluid-bed or moving-bed) each with 2 columns (reactors/regenerators), 1 bank of heat exchangers, 1 pipe furnace, and 1 compressor building serving both units 1 Possible fractionating unit with 2 columns, 2 pipe furnaces, 1 bank of heat exchangers or accumulators, and 1 compressor building 1 U/I processing unit 4 Extractors/absorbers 1 Building with 4 probable treatment drums each 9 meters long and 1 probable mixing or treatment tank 25X1 4 Cylindrical storage tanks each 15 meters in diameter
	(2) Fractionating	1 Fractionating unit with 1 column, 1 bank of heat exchangers, 1 pipe furnace, 1 compressor-type building, 2 probable mixers/treatment tanks, 2 support buildings, and 1 horizontal tank 25X1
G	U/I Secondary Processing	1 Unit with at least 2 fractionators/extractors, 1 pipe furnace, 1 bank of heat exchangers or accumulators, 1 compressor building, and 1 horizontal tank 9 meters long 1 Unit with a column or group of columns in scaffolding, 2 banks of heat exchangers, 1 possible steam generator, and 1 compressor building with a line of 4 thin columns/extractors 1 Compressor building with associated possible reactor and 2 horizontal tanks or accumulators 2 Cylindrical tanks 21 meters in diameter
H	Secondary Thermal Processing	
	(1) Possible Thermal Reforming/Cracking	3 Similar units, each with 2 clusters of columns (1 with a fractionator and 3 probable stripping columns; 1 with 2 pairs of columns, 2 possible reactors, and possible covered processing equipment), 1 small bank of cooling coils, 2 pipe furnaces, 1 compressor building, 4 horizontal storage or treatment drums each 12 meters long. In addition, 1 of the units has 3 cylindrical tanks 3 meters in diameter, 1 of the units has 1 cylindrical tank 3 meters in diameter and 2 tank bases, and 1 of the units has 1 cylindrical tank 3 meters in diameter 7 Miscellaneous support buildings 14 Cylindrical storage tanks 5 12-meter-diameter 9 25X1 1 Gasholder 27 meters in diameter
	(2) Construction Activity	U/I unit -- midstage of construction

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Area	Functional Description	Equipment and Facilities
I	Possible Catalytic Conversion/Treating	1 Unit with 2 columns (possible reactors), a cluster of equipment containing at least 5 thin columns, 1 pipe furnace, 1 possible steam generator/gas purification building, 2 compressor buildings, and 1 large bank of heat exchangers 1 Unit with at least 2 columns (possible fractionators), 2 pipe furnaces, 1 compressor building, and 1 small bank of heat exchangers 1 Support building 8 Cylindrical, pressure-type or treatment tanks each [redacted] 25X1
J	Possible Gas Refining (1) Possible Polymerization	1 Row of at least 6 reactor/fractionator columns 1 Possible steam generator 1 Possible gas purification building with 8 cells 2 Banks of heat exchangers 1 Large compressor building 1 Control/processing building 3 Support buildings 13 Cylindrical storage tanks 1 [redacted] 25X1 6 10.5-meter-diameter 2 [redacted] 25X1 2 2 3-meter-diameter 1 Tank base u/c
	(2) Construction Activity	Midstage of construction
K	Possible Extraction (Petrochemical Stock)	1 Unit with at least 3 tall columns (extractors/fractionators), 1 compressor building, 2 support buildings, 11 small cylindrical storage/treatment tanks, 2 horizontal storage tanks each [redacted] 25X1 [redacted] 25X1 1 U/I processing unit 1 Treatment building with 7 horizontal drums 2 12-meter-long 3 9-meter-long 2 [redacted] 25X1 1 Support building 6 Horizontal storage tanks each 12 meters long
L	Probable Light-Ends Processing and Stabilization	1 Unit with a row of 5 columns (absorbers/extractors), 1 fractionator, 1 compressor building, 1 control building, and 1 gasholder 15 meters in diameter 1 Unit with 2 u/i columns, 1 compressor building, and 1 building with possible accumulator on the roof 1 Unit with processing building and attached u/i equipment and 1 probable compressor/pump building 4 Cooling towers, each with 9 cells 5 Miscellaneous buildings 7 Cylindrical storage tanks 2 [redacted] 25X1 2 18-meter-diameter 2 [redacted] 25X1 1 20 Horizontal storage tanks each 12 meters long 3 Water storage reservoirs

25X1

Area	Functional Description	Equipment and Facilities
M	Catalytic Cracking	2 Cracking units (probable Thermofor-type) each with reactor and regenerator stacked, 2 catalyst hoppers, an elevator or blower tower, 1 fractionator, 1 bank of cooling coils, 1 pipe furnace, 1 compressor building, 1 control building, 1 light-ends recovery unit with small control building, and 2 cylindrical tanks each 6 meters in diameter 3 Miscellaneous buildings 3 Cooling towers, each with 3 cells 2 Cylindrical storage tanks each 21 meters in diameter 3 Water storage reservoirs
N	Administration	21 Administration, maintenance, storage, and support buildings 6 Cylindrical storage tanks each [redacted] 25X1 25X1
O	Engineering and Support	1 Workshop, 89 by 63 meters, with an administration section 10 by 58 meters 1 Workshop, 47 by 50 meters, with an administration section 9 by 45 meters 12 Miscellaneous support buildings
P	U/I Processing (Probable Petrochemical)	1 Large u/i processing unit 1 Compressor and control building with 2 attached columns 1 Small compressor/pump building 3 Miscellaneous buildings 1 Building with 4 horizontal settling drums each 12 meters long 11 Cylindrical storage tanks 10 12-meter-diameter 1 [redacted] 25X1 1 Spherical tank 9 meters in diameter
Q	U/I Processing	1 Unit with 2 rows of processing equipment, 1 bank of heat exchangers, 1 pipe furnace, 1 compressor building, 1 support building, and 5 cylindrical tanks each 3 meters in diameter 1 Unit with 2 columns, 1 cluster of processing equipment, 1 pipe furnace, 1 compressor/pump building, 1 control building, and 6 cylindrical tanks each 3 meters in diameter 3 Miscellaneous buildings 1 Building with 4 settling drums each 12 meters long 4 Cooling towers, 2 with 9 cells and 2 with 12 cells 3 Cylindrical storage tanks each 12 meters in diameter 1 Horizontal tank 12 meters long 1 Water storage reservoir 1 Excavation for possible storage basin

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Area	Functional Description	Equipment and Facilities
R	Probable Thermal Cracking	2 Units, each with a possible reactor, a flash chamber, a fractionator, 1 compressor building, 2 pipe furnaces, 2 support buildings, and a light-ends unit with 3 thin columns, a building, 2 horizontal tanks, and 2 cylindrical tanks each 3 meters in diameter 6 Miscellaneous buildings 27 Cylindrical storage tanks 8 [redacted] 25X1 6 9-meter-diameter 10 [redacted] 25X1 3 6-meter-diameter
S	U/I Processing	1 Unit with a row of at least 4 columns, 1 piece of u/i equipment, 2 extractors/treatment columns, 1 bank of cooling coils, 2 compressor/process buildings, 1 control building, 2 horizontal tanks each 9 meters long; and an associated small unit with 1 probable extractor, 1 item of u/i processing equipment, cooling coils, and 1 small storage tank (not measured) 1 Unit with 2 columns/reactors, 1 pipe furnace, 2 banks of heat exchangers, 1 compressor building, 1 control building, 3 support buildings, 1 storage or mixing tank (not measured), 3 horizontal storage/treatment tanks, 1 small possible spherical tank, and a possible light-ends unit with a row of 3 extractors, 1 associated small column, 1 bank of cooling coils, 1 compressor building, 2 cylindrical tanks each 3 meters in diameter, and 4 horizontal tanks each 9 meters long 7 Miscellaneous buildings 37 Cylindrical tanks 12 9-meter-diameter 20 [redacted] 25X1 5 6-meter-diameter 14 Horizontal storage tanks 6 15-meter-long 8 9-meter-long
T	Primary Distillation	2 Multistage distillation units, each with 1 vacuum, 1 large atmospheric, and 3 extractor/rerun/stabilizing columns, 2 pipe furnaces, 2 banks of heat exchangers or accumulators, 4 vertical accumulators, 1 compressor/control building, 1 treatment building with 7 treating and desalting drums each 9 meters long, and 5 cylindrical storage tanks (3 are 18 meters in diameter and 2 are 3 meters in diameter). One unit has 4 very small probable chemical storage tanks 1 U/I unit with at least 6 short columns and a compressor/pump/control building 13 Miscellaneous support buildings 2 Venturi-type cooling towers 2 Water storage reservoirs

Area	Functional Description	Equipment and Facilities
U	Primary Distillation and Possible Thermal Cracking/Reforming	
	(1) Combination Unit	1 Row of 5 columns (1 vacuum, 1 large atmospheric, and 3 others) 2 U/I units/pieces of processing equipment (including possible reactors) 4 Pipe furnaces 3 Banks of heat exchangers/accumulators (1 covered) 1 Compressor building 1 Control building 1 Treatment building with 6 treatment/desalting drums 4 Support buildings 12 Cylindrical tanks 3 6-meter-diameter 2 [redacted] 25X1 7 3-meter-diameter 2 Horizontal tanks each 9 meters long
	(2) Probable Combination Unit and Intermediates Storage	1 Row of at least 6 columns including 1 vacuum still 3 Pipe furnaces 5 Banks of heat exchangers or accumulators (4 short banks and 1 covered long bank) 1 Compressor building 1 Treatment building with 4 treatment/desalting drums each 12 meters long 1 Treatment/control building with 4 drums (not measured) 3 Support buildings 2 Tanks or mixers (not measured) 2 Chemical tanks (not measured) 7 Cylindrical storage tanks 5 12-meter-diameter 2 [redacted] 25X1
	(3) Construction Activity	Very early stage
	(4) Water Cooling and Storage	2 Buildings 2 Venturi-type cooling towers 2 Water storage reservoirs 2 Horizontal tanks each 15 meters long 1 Transformer substation with 2 buildings
V	Gas Processing	3 Units each with a cluster of u/i equipment, 1 compressor building, a short bank of heat exchangers, and 3 horizontal tanks [redacted] 25X1 1 Unit with 1 bank of u/i equipment, 1 compressor/control building, 2 support buildings, 3 tanks/mixers/absorbers each 3 meters in diameter, 12 horizontal storage or washing drums (10 are 15 meters long and 2 are 9 meters long), and 2 spherical tanks each 12 meters in diameter 1 Unit with 1 compressor building, 1 bank of heat exchangers, 2 cylindrical tanks each 3 meters in diameter, 4 horizontal storage/washing drums (2 are 15 meters long and 2 are 9 meters long), and 3 spherical tanks each 12 meters in diameter

[redacted] 25X1

Area	Functional Description	Equipment and Facilities
		1 Unit with 1 compressor/control building, 2 banks of heat exchangers, 1 support building, 4 cylindrical tanks each 3 meters in diameter, 1 horizontal drum 9 meters long, and 6 spherical tanks each 12 meters in diameter 2 Miscellaneous support buildings
W	Lubricating Oil Production (1) Support	1 Storage building 105 by 25 meters 1 Storage building 81 by 38 meters 6 Scattered buildings A separately secured area with 4 small buildings
	(2) Processing (Clay Treatment, Dewaxing and Possible Solvent Extraction)	1 Combination processing area with a compressor building (dewaxing) with high end section (clay treatment) connected by conveyer with rail-served clay receiving and storage building, 1 row of possible extractors, 2 small pipe furances, 8 probable settling tanks (dewaxing) each 3 meters in diameter, and 2 possible solvent storage tanks (not measured) 2 Cooling towers, each with 3 cells 2 Support buildings 1 Water storage reservoir
	(3) Fractionating or Possible Deasphalting	1 Fractionating or stripping column 1 Pipe furnace 1 Bank of heat exchangers 1 Compressor building 4 Horizontal tanks each 6 meters long 2 Possible cylindrical tanks (not measured)
	(4) U/I Processing	2 Columns, possible extractors 1 Building 14 Cylindrical storage tanks 8 [redacted] 25X1 6 3-meter-diameter
	(5) Storage and Shipping	2 Administration buildings 1 Compressor/pump building 1 Rail-served storage building 2 Support buildings 52 Cylindrical storage tanks 17 [redacted] 25X1 23 9-meter-diameter 12 [redacted] 25X1
X	Support and Products Shipping and Storage (1) Transformer Substation	Walled area with control building
	(2) Packing, Shipping, and Treating	17 Storage, packing, shipping and support buildings 15 Cylindrical storage tanks 2 9-meter-diameter 6 6-meter-diameter 7 [redacted] 25X1 8 Storage or treatment tanks 3 3-meter-diameter 5 [redacted] 25X1 27 Horizontal storage tanks 8 [redacted] 25X1 19 12-meter-long 1 Horizontal storage or settling drum 9 meters long

Area	Functional Description	Equipment and Facilities
	(3) Blending, Packing, and Shipping	1 Large building, 152 by 53 meters, with 12 probable agitators/blenders projecting through roof 1 Large storage and packing building 152 by 38 meters 1 Shipping building 4 Support buildings 1 Small pipe furnace 10 Cylindrical storage tanks 2 9-meter-diameter 6 6-meter-diameter 2 3-meter-diameter 5 Horizontal tanks 2 12-meter-long 1 [redacted] 25X1 2 9-meter-long
	(4) Possible Pumping Station (Pipeline Terminal)	2 Compressor/pump buildings 1 Building with attached scrubber or absorber column 2 Support buildings 9 Cylindrical storage tanks 1 9-meter-diameter 1 [redacted] 25X1 1 6-meter-diameter 6 [redacted] 25X1 3 Horizontal storage or settling drums each 15 meters long
	(5) Products Storage	8 Miscellaneous buildings 87 Cylindrical storage tanks 6 24-meter-diameter 19 21-meter-diameter 28 18-meter-diameter 6 [redacted] 25X1 4 12-meter-diameter 5 9-meter-diameter 13 6-meter-diameter 2 [redacted] 25X1 4 3-meter-diameter 32 Horizontal storage tanks each 12 meters long 6 Probable semiburied storage tanks (not measured)
	(6) Construction Activity	Early stage of construction
Y	Crude Oil and Products Storage and Shipping	24 Miscellaneous buildings 2 Loading racks 56 Cylindrical storage tanks 9 48-meter-diameter 3 36-meter-diameter 22 24-meter-diameter 2 21-meter-diameter 3 18-meter-diameter 6 [redacted] 25X1 8 9-meter-diameter 2 [redacted] 25X1 1 6-meter-diameter 1 Semiburied tank [redacted] in diameter 25X1 2 Semiburied reservoirs each 21 by 21 meters 1 Horizontal tank 12 meters long 5 Cylindrical storage tanks u/c

Area	Functional Description	Equipment and Facilities
Z	Crude Oil Receiving and Storage	6 Miscellaneous buildings 15 Cylindrical storage tanks 2 48-meter-diameter 11 24-meter-diameter 2 21-meter-diameter 1 Possible semiburied reservoir (not measured) 2 Tank bases u/c

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Map

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Requirement

COMIREX NO2

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